

Circles Class 10 — the whole chapter is two theorems

Geometry unit · 15 marks · tested as proofs, short answers and MCQs

Class 10 Circles = tangents only. Two theorems carry the chapter — the marks are in how completely you write the proof.

The words you must use correctly

Tangent	A line that touches the circle at exactly one point.
Point of contact	The single point where the tangent meets the circle.
Secant	A line that cuts the circle at two points (contrast only).
Length of a tangent	Distance from the external point to the point of contact.
How many tangents?	0 from a point inside · 1 from a point on the circle · 2 from a point outside.

Theorem 1 — the tangent is perpendicular to the radius

The tangent at any point of a circle is perpendicular to the radius through the point of contact.

If XY is a tangent at P and O is the centre $\Rightarrow OP \perp XY$, so $\angle OPX = 90^\circ$

This is the theorem that turns every tangent question into a **right-angled triangle** question — which is why Pythagoras appears in almost every numerical.

Theorem 2 — tangents from an external point are equal

The lengths of the two tangents drawn from an external point to a circle are equal.

From external point P : $PA = PB$ and $PA^2 = OP^2 - r^2$

Three free results come with it: $\angle OAP = \angle OBP = 90^\circ$, OP **bisects** $\angle APB$ and $\angle AOB$, and $\angle AOB + \angle APB = 180^\circ$ (angles of quadrilateral $OAPB$).

How CBSE asks it

Question type	Skill tested	Typical marks
Prove tangent $\perp$ radius	Reasoning	3 or 5
Prove tangents from an external point are equal	Reasoning	3 or 5
Find a length using $PA^2 = OP^2 - r^2$	Application	1 or 2
Angle chase in quadrilateral $OAPB$	Concept	2 or 3

Key takeaways

- **Two theorems, whole chapter.** Tangent $\perp$ radius, and equal tangents from an external point.
- **Every tangent is a right angle waiting to be used** — draw the radius to the point of contact first.
- $PA^2 = OP^2 - r^2$ solves most 1–2 mark numericals in one line.
- **Reasons earn the marks**, not the steps. Write the reason beside every statement.
- **Label the diagram** — centre, point of contact, external point. Mislabelling loses marks you have earned.

Worked example — the proof and the numerical, written for marks

One external point, both theorems, and exactly how the examiner reads it

$$OA \perp AP \cdot PA = PB \cdot PA^2 = OP^2 - r^2$$

THE 5-MARK PROOF

Prove that the lengths of tangents drawn from an external point to a circle are equal.

Given: A circle with centre O. P is a point outside it. PA and PB are tangents touching the circle at A and B.

To prove: $PA = PB$. **Construction:** Join OA, OB and OP.

Proof: $\angle OAP = \angle OBP = 90^\circ$ (tangent $\perp$ radius at the point of contact)

In right triangles OAP and OBP: $OA = OB$ (radii of the same circle), $OP = OP$ (common hypotenuse)

$\Rightarrow \triangle OAP \cong \triangle OBP$ (RHS congruence) $\Rightarrow PA = PB$ (CPCT). Hence proved.

THE NUMERICAL

O is the centre of a circle of radius 8 cm. P is a point with $OP = 17$ cm. PA and PB are tangents from P. Find PA, the perimeter of quadrilateral OAPB, and its area.

Step 1 — make the right angle. $\angle OAP = 90^\circ$ (tangent $\perp$ radius), so $\triangle OAP$ is right-angled at A.

Step 2 — Pythagoras. $PA^2 = OP^2 - OA^2 = 17^2 - 8^2 = 289 - 64 = 225 \Rightarrow PA = 15$ cm.

Step 3 — use Theorem 2. $PB = PA = 15$ cm (equal tangents from P).

Step 4 — perimeter. $OA + AP + PB + BO = 8 + 15 + 15 + 8 = 46$ cm.

Step 5 — area. OAPB is two congruent right triangles: $2 \times \frac{1}{2} \times 8 \times 15 = 120$ cm².

Check: 8, 15, 17 is a Pythagorean triple — $64 + 225 = 289$. The numbers were chosen to be exact.

WHERE THE MARKS ACTUALLY GO

Wrote $PA = 15$ with no reason → loses the method mark; the examiner needs "tangent $\perp$ radius" in writing. **Used OP as a leg**

instead of the hypotenuse → the whole answer collapses; OP is always opposite the right angle. **Assumed $PA = PB$ without**

naming Theorem 2 → the statement is right, the mark is not awarded. **Skipped the congruence criterion (RHS)** in the proof

→ a guaranteed mark lost in a 5-mark question.

NOW TRY THIS ONE

Two concentric circles have radii 5 cm and 3 cm. Find the length of the chord of the larger circle that touches the smaller circle.

Hint: the chord is a tangent to the small circle, so the radius to the point of contact is perpendicular to it — and that perpendicular from the centre **bisects** the chord. Half-chord = $\sqrt{5^2 - 3^2} = 4$, so the chord is **8 cm**.

Stop losing proof marks you have already earned

- **Chapter 1 is completely free** — start on examfront today, no payment needed.
- **Mistake identification** tells you whether you lost the mark on concept, method or presentation.
- **Anytime tests** — practise Circles the moment you finish reading this sheet.
- **Weekly tests** keep the tangent theorems fresh instead of fading after one revision.
- **Full mock tests before the exam** — board-pattern papers, timed, with a marks-by-mistake report.

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